Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/US04/043043

International filing date: 21 December 2004 (21.12.2004)

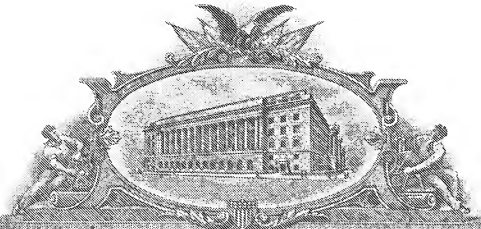
Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 60/531,874
Filing date: 22 December 2003 (22.12.2003)

Date of receipt at the International Bureau: 11 February 2005 (11.02.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

World Intellectual Property Organization (WIPO) - Geneva, Switzerland
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE

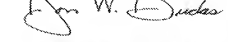
United States Patent and Trademark Office

January 24, 2005

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: ***60/531,874***
FILING DATE: ***December 22, 2003***
RELATED PCT APPLICATION NUMBER: ***PCT/US04/43043***

Certified by



Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

Please type a plus sign (+) inside this box → [+]

PTO/SB/16 (5-03)
Approved for use through 04/30/2003. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Ralph G.	JELIC	1602 Pika Road, Boulder, Colorado 80302
Wendell B.	COLSON	14 Byron Road, Weston, Massachusetts 02493
Paul G.	SWISZCZ	671 Bow Mountain Road, Boulder, Colorado 80304
Kim	JELIC	1602 Pike Road, Boulder, Colorado 80302

☒ *Additional inventors are being named on the* 1 *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

RETRACTABLE SHADE FOR COVERINGS FOR ARCHITECTURAL OPENINGS

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☒ Customer Number 20686 → *Place Customer Number Bar Code Label here*

OR *Type Customer Number here*

☐ Firm or Individual Name

Address

Address

City | State | ZIP

Country | Telephone | Fax

ENCLOSED APPLICATION PARTS *(check all that apply)*

☒ Specification *Number of Pages* 23 ☐ CD(s), Number

☒ Drawing(s) *Number of Sheets* 27 ☐ Other (specify)

☐ Application Data Sheet. See 37 CFR 1.76

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT *(check one)*

		FILING FEE AMOUNT ($)
☐	A check or money order is enclosed to cover the filing fees	
☒	The Director is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number 04-1415	$160.00
☐	Payment by credit card. Form PTO-2038 is attached.	

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

SIGNATURE [signature] Date 12-22-03

TYPED or PRINTED NAME Gary M. Polumbus REGISTRATION NO. *(if appropriate)* 25,364

Docket Number: 33258/US

TELEPHONE 303-628-1500

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

PROVISIONAL APPLICATION COVER SHEET
Additional Page

PTO/SB/16 (8-00)
Approved for use through 10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Docket Number	33258/US	Type a plus sign (+) inside this box →	+

INVENTOR(S)/APPLICANT(S)

Given Name (first and middle [if any])	Family or Surname	Residence (City and either State or Foreign Country)
Daniel M.	FOGARTY	66 Belvidere Avenue, Framingham, Massachusetts 01702
Jason T.	THRONE	P.O. Box 770719, Steamboat Springs, Colorado 80487

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

PATENT
Attorney Docket No. 33258/US
Express Mail Label No. EV410059576US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	
Ralph G. JELIC et al.	Examiner:
Serial No.	Art Unit:
Filed:	
For: RETRACTABLE SHADE FOR COVERINGS FOR ARCHITECTURAL OPENINGS	

CERTIFICATE OF MAILING BY EXPRESS MAIL

Mail Stop: Provisional Patent Application
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The undersigned hereby certifies that the following documents:

1. Provisional Application for Patent Cover Sheet;
2. Specification (23 pages);
3. Drawings (27 pages);
4. Certificate of Mailing by Express Mail; and
5. Return Card,

relating to the above application, were deposited as "Express Mail," Mailing Label No. EV410059576US with the United States Postal Service, addressed to Mail Stop Provisional Patent Application, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 22 day of December, 2003.

Mailer
DORSEY & WHITNEY LLP
USPTO Customer No. 20686

RETRACTABLE SHADE FOR COVERINGS FOR ARCHITECTURAL OPENINGS

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates generally to retractable coverings for architectural openings and fabrics for use therein wherein the fabric includes a flexible support structure and a plurality of vanes or slats mounted on the support structure with the movement of the vanes or slats being dependent upon the movement of the support structure.

Description of the Relevant Art

Retractable coverings for architectural openings have assumed numerous forms over a long period of time. Originally, coverings for architectural openings such as windows, doors, archways or the like consisted principally of fabric draped across the architectural openings. Such early forms of coverings evolved into retractable roller shades, curtains, draperies, and the like wherein the covering could be extended across the architectural opening or retracted to a top or side of the opening.

An early but still popular form of covering for architectural openings is the Venetian blind wherein a plurality of vertically extending cord ladders support parallel horizontally extending slats in a manner such that the slats can be pivoted about their longitudinal axes between open and closed positions and the entire blind can be moved between an extended position wherein it extends across the architectural opening and a retracted position where the slats are accumulated in a vertical stack adjacent to the top of the architectural opening.

Vertical blinds are also available which are very similar to Venetian blinds except the slats or vanes extend vertically and are suspended from their upper ends for pivotal movement about their longitudinal vertical axes. The entire blind can be

extended across the opening or retracted adjacent to one or more sides of the opening in a horizontal stack.

More recently, cellular shades have become popular not only because they are aesthetically attractive but also because they provide improved insulation across architectural openings where typically heat can otherwise be lost. Cellular shades have assumed numerous forms including a plurality of longitudinally extending tubes made of a flexible or semi-rigid material which can be transversely collapsed. The cellular shade can thereby be extended across an architectural opening or retracted adjacent the top or bottom edge of the opening with the cells transversely collapsed in a vertical stack.

A more recent form of cellular shade includes a pair of spaced flexible sheets, which are typically sheer fabric, with the sheets being interconnected by vertically spaced horizontally extending vanes which may be rigid or flexible. The vanes are movable between open and closed positions by shifting the sheets of material in opposite vertical directions. The entire covering can be extended across the opening or retracted along one edge of the opening typically by rolling the fabric material comprised of the sheets of material and interconnecting vanes about a roller.

The recent emphasis on design in homes and building structures has maintained pressure on the industry to create unique aesthetically attractive coverings for architectural openings which also have utilitarian functions such as insulating the opening to minimize the loss of heat therethrough.

It is to respond to the demand of the market that the present invention has been made.

BRIEF SUMMARY OF THE INVENTION

The covering of the present invention includes a fabric material that can be extended across an architectural opening or retracted adjacent an edge of the opening and a control system for manipulating the fabric material. The fabric material can assume various forms but wherein generally a support structure supports a plurality of slats or vanes in a manner such that the movement of the vanes is dependent upon movement of the support structure. The support structure could be in the form of a

sheet of flexible material, strips of flexible ribbon, tape, or the like, flexible elongated strands or elements which could be monofilaments, cord or string made of natural or synthetic fibers, transversely collapsible cellular structures, or the like. The support structure while typically being vertically oriented can also be horizontally disposed so the covering can be used in a skylight as well as on windows, doors, archways, or the like.

The slats or vanes, which are supported on the support structure, can assume numerous forms including rigid, semi-rigid or flexible strips of material of various configurations and relationships connected to the support structure at spaced locations to define cellular vanes between connection locations. The vanes formed from the strips of material are connected to the support structure in a manner such that they can be gathered into a compact stack adjacent one edge of an architectural opening when the fabric is mounted on a control system for extending or retracting the fabric structure across the architectural opening. The control system for such a covering in the preferred embodiment is a lift mechanism which lifts or gathers the support structure and consequently the vanes that follow into a stack adjacent to an edge of the architectural opening.

As will be appreciated with the detailed description that follows, the vanes can be interconnected with each other, connected individually to the support structure or they can be mounted on the support structure so that each vane is not directly secured to the support structure but rather the support structure is used to engage and lift the lowermost vanes in the fabric when the covering is being retracted thereby causing the remaining vanes to accumulate and stack on the lowermost vanes.

Other aspects, features and details of the present invention can be more completely understood by reference to the following detailed description of preferred embodiments, taken in conjunction with the drawings and from the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a fragmentary isometric illustrating a first embodiment of a covering in a fully extended position in accordance with the present invention.

Fig. 2 is a side elevation of the covering as shown in Fig. 1.

Fig. 3A is a side elevation similar to Fig. 2 with the covering partially retracted.

Fig. 3B is an enlarged fragmentary side elevation of the covering of Fig. 1 in a partially retracted position.

Fig. 3C is a partially exploded side elevation similar to Fig. 3B.

Fig. 4 is a side elevation of the covering of claim 1 in a fully retracted position.

Fig. 5 is an exploded side elevation of a plurality of vanes used in a second embodiment of the covering of the present invention illustrating the manner in which the vanes are interconnected.

Fig. 6A is an enlarged side elevation of a vane used in the covering of Fig. 5.

Fig. 6B is a further enlarged fragmentary side elevation of an upper segment of the vane as shown in Fig. 6A.

Fig. 6C is a fragmentary elevation similar to Fig. 6B showing the upper segment before folding.

Fig. 7 is an isometric of a third embodiment of a fabric for use in a covering in accordance with the present invention and with the fabric in a fully extended position.

Fig. 7A is a side elevation of the fabric as shown in Fig. 7.

Fig. 7B is an isometric of the fabric of Fig. 7 shown in a partially retracted position.

Fig. 7C is a side elevation of the fabric as shown in Fig. 7B with a lift mechanism shown in dashed lines.

Fig. 7D is an isometric of the fabric of Fig. 7 in a fully retracted position.

Fig. 7E is a side elevation of the fabric as shown in Fig. 7D with a lift mechanism shown in dashed lines.

Fig. 7F is an enlarged fragmentary elevation of an uppermost cell in the support structure of the fabric of Fig. 7 connected to the next lower cell and with a slat connected to the uppermost cell.

Fig. 8A is an isometric of a fabric similar to that of Fig. 7 in a fully extended position but wherein the slats are flat in cross section rather than arcuate.

Fig. 8B is a side elevation of the fabric of Fig. 8A.

Fig. 9A is an isometric view of a fourth embodiment of a fabric in accordance with the present invention shown in a fully extended position.

Fig. 9B is a side elevation of the fabric as shown in Fig. 9A.

Fig. 9C is an enlarged side elevation of the fabric of Fig. 9A in a fully retracted position and showing a lift system in dashed lines.

Fig. 9D is a further enlarged fragmentary side elevation of the fabric of Fig. 9A showing the uppermost cell of the support structure connected to the next lower cell and with the slats connected to opposite sides of the uppermost cell.

Fig. 10A is an isometric of a fifth embodiment of a fabric in accordance with the present invention shown in a fully extended position.

Fig. 10B is a side elevation of the fabric as shown in Fig. 10A.

Fig. 10C is an isometric of a variation of the fabric of Fig. 10A in a fully extended position with slats on only one side of the cellular support structure.

Fig. 11A is an isometric of a fully extended variation of the embodiment of Figs. 9A and 9B with slats on only one side of the cellular support structure.

Fig. 11B is a side elevation of the fabric as shown in Fig. 11A.

Fig. 11C is an isometric of the fabric of Fig. 11A in a partially retracted position.

Fig. 11D is a side elevation of the fabric of Fig. 11A in a partially retracted position.

Fig. 12A is an isometric of a sixth embodiment of a fabric in accordance with the present invention shown in a fully extended position.

Fig. 12B is a side elevation of the fabric as shown in Fig. 12A.

Fig. 13A is an isometric of a seventh embodiment of a fabric in accordance with the present invention in a fully extended position.

Fig. 13B is a side elevation of the fabric of Fig. 13A.

Fig. 14A is an isometric of an eighth embodiment of a fabric in accordance with the present invention in a partially extended position.

Fig. 14B is a side elevation of the fabric as shown in Fig. 14A.

Fig. 14C is a side elevation of the fabric shown in Fig. 14A in a fully retracted position.

Fig. 14D is a side elevation of the fabric of Fig. 14A in a fully extended position.

Fig. 15A is a side elevation of a variation of the fabric of Fig. 14A with slats on both sides of the pleated support structure and with the fabric fully extended.

Fig. 15B is an isometric of the fabric as shown in Fig. 15A in a partially retracted position.

Fig. 15C is an isometric of the fabric shown in Fig. 15A in a fully extended position.

Fig. 15D is an isometric of the fabric of Fig. 15A.

Fig. 16A is a side elevation of a ninth embodiment of a fabric in accordance with the present invention shown in a fully extended position.

Fig. 16B is an enlarged side elevation of the fabric shown in the circled area of Fig. 16A.

Fig. 16C is a side elevation of the fabric shown in Fig. 16A in a partially retracted position.

Fig. 17A is a fragmentary isometric showing a tenth embodiment of a fabric in accordance with the present invention mounted horizontally and in a fully extended position.

Fig. 17B is a fragmentary vertical section of the fabric of Fig. 27A in a fully retracted position.

Fig. 17C is a fragmentary vertical section of the fabric of Fig. 27A in a fully extended position.

Fig. 18A is a fragmentary side elevation of an eleventh embodiment of a fabric in accordance with the present invention in a fully extended position.

Fig. 18B is an enlarged side elevation showing the encircled area of Fig. 18A.

Fig. 18C is a side elevation of the fabric of Fig. 18A in a fully retracted position.

Fig. 18D is a side elevation of the fabric of Fig. 18A in a partially retracted position.

DETAILED DESCRIPTION OF THE INVENTION

The cellular shade of the present invention includes a control system and a fabric supported on and manipulated by the control system. The fabric is disclosed in different embodiments wherein it includes a support structure on which a plurality of slats or vanes are supported in a manner such that the movement of the slats or vanes is responsive to retraction or extension of the support structure on which they are mounted and operatively associated. As will be appreciated from the detailed descriptions that follow, the slats or vanes can be in the form of flexible, rigid, or semi-rigid strips of material connected to the support structure at spaced locations. The slats or vanes are operatively connected to the support structure to move in response to movement of the support structure. As used in this Specification, the term "flexible" refers to materials that are capable of being flexed with examples of such materials being sheets of vinyl, woven or non-woven fabric, cords of natural or synthetic fibers, monofilaments, and the like. The term "semi-rigid" refers to materials that are somewhat stiff but can be flexed or folded. Examples of such materials would be resin reinforced fabric, polyvinyl chloride, and the like. The term rigid refers to stiff materials which could be resin reinforced fabrics (to a greater degree than the "semi-rigid" fabrics), polyethylene, wood, aluminum or other metals, and the like.

With reference first to Figs. 1-4, a first embodiment 30 of the shade or covering of the present invention can be seen to include a headrail 32 having an arcuate rigid valence 34 supported thereon and a fabric 36 that includes a support structure in the form of a plurality of suspended flexible cords or elements 38 that carry a weighted bottom rail or ballast bar 40 at their lower ends and a plurality of interconnected slats 42 suspended from the headrail and in operative engagement with the support structure.

As best seen in Figs. 2 and 4, the headrail 32, which is adapted to be mounted to a frame (not shown) of an architectural opening in any conventional manner includes an extruded element 44 that is interlocked with a base member 46 with the extruded element including channels, beads, and other formations for various purposes. The extruded element has one channel 48 formed therein to receive an

outer free edge 50 of the base member 46 and a ridge 52 that is received in a channel 54 formed in the base member so the extruded element is suspended from the base member but can be slid longitudinally of the base member to mount on or remove the extruded element from the base member. The extruded element further has a rounded elongated bead 56 along its forwardmost free edge adapted to be received in a channel 58 formed along the inside upper edge of the valence 34 so the valence, which is arcuate in transverse cross-section, can depend therefrom to conceal the fabric and the remainder of the headrail when the shade or covering is in the retracted position of Fig. 4. When the shade is extended as shown in Figs. 1-3C, the valence provides a decorative finish to the shade while blocking the view of the headrail components from inside a room in which the shade is mounted.

The support structure, as mentioned previously, includes a plurality of vertically extending flexible elements 38 which may be microfibers, cords, ribbons, tapes, or the like, which are suspended from a control system (not seen) mounted in the headrail 32. The control system may be a conventional system wherein the elements 38 can be accumulated within the headrail when the shade is retracted or extended therefrom when the shade is extended. The control system includes a pull cord 60 (Figs. 1, 2 and 3A) for operating the control system. Pulling downwardly on the pull cord causes the flexible elements 38 to be raised and accumulated within the headrail as the weighted bottom rail 40 is lifted. Upward movement of the bottom rail causes it to engage the lowermost slats and lift the interconnected slats into the retracted position of Fig. 4 as will be described in more detail later. By releasing a brake (not seen) commonly used in such control systems for holding the shade at any degree of extension, the weighted bottom rail can fall by gravity allowing the interconnected slats to expand from the retracted position of Fig. 4 through an intermediate position of Fig. 3A to the fully expanded position of Fig. 2.

The interconnected slats 42 are probably best described by reference to Figs. 3B and 3C. Each slat has a lower rigid or semi-rigid component 43 and an upper flexible component 45, the lower end of the flexible component being secured as by adhesive, ultrasonic bonding, or the like, to the upper edge of the lower component at an intermediate location 47 on the slat. While the upper component needs to be

durable, its flexibility is preferably extreme such as might be found in fabrics such as silk. The lower component is illustrated as being arcuate in transverse cross-section, even though as will be appreciated with the description that follows, the slat could be of any desired transverse cross-sectional configuration such as flat, serpentine, wavy, or the like. The lower component 43 has an inner concave surface to which the lower edge of the associated upper flexible component can be secured. Further, each slat is secured to the next adjacent upper slat by attaching the upper end of the upper component 45 to the intermediate location 47 where an upper component was secured along its lower edge to a lower component of the next adjacent upper slat. This attachment can also be with adhesive, ultrasonic bonding, or the like. As viewed in Fig. 3C, the sequential steps for assembling a slat 42 and connecting it to the next adjacent upper slat is shown moving from the top of Fig. 3C to the bottom. As will be appreciated, the illustrated upper two slats show the upper and lower components 45 and 43, respectively, separated with the next adjacent lower aligned slats showing the upper component of each slat connected to its lower component. Moving downwardly, the upper edge of each upper component is secured to the intermediate location 47 of the next adjacent upper slat where its upper component and lower component are connected. It is also important to note the adjacent intermediate locations in the fabric are offset on either side of a vertical plane for a purpose to be described hereafter.

In this manner, a fabric structure made from interconnected slats 42 having flexible upper components 45 and semi-rigid or rigid lower components 43 is assembled into a unified body. As appreciated by reference to Fig. 3A, substantially vertically aligned holes (not seen) can be provided in the flexible upper components of the interconnected vanes through which the flexible elements 38 of the support system can be passed. As can be appreciated by reference to Figs. 1, 2, 3A and 4, once the slats are mounted on these flexible support elements, which are preferably centered laterally in the fabric, and with the weighted bottom rail or ballast 40 positioned in the crotch beneath the two lowermost slats in the fabric with alternate intermediate locations being on either side of the elements 38, the fabric can be extended or retracted between the positions of Figs. 1 and 4, respectively, with the

control system. As mentioned previously, when the brake on the control system is released, the weighted bottom rail 40 descends by gravity allowing the interconnected slats to expand from the retracted position of Fig. 4 to the extended position of Fig. 1. Of course, when the flexible support elements 38 are drawn into the headrail by pulling downwardly on the pull cord 60, the weighted bottom rail is raised from its lowermost position of Fig. 1 to its uppermost position of Fig. 4 and in passing between the positions gathers the slats into a compact stack as seen in Fig. 4. It is best appreciated by reference to Fig. 3A, which shows the fabric of the covering in a partially retracted position, that the slats 42 are only gathered on the bottom rail 40, which are physically forced to gather so that all slats above the gathered slats remain in their fully extended position. In this manner, only a lower group of slats that are being raised and gathered on the bottom rail begin to flair outwardly while the unaffected slats thereabove remain unmoved until physically forced into the gathered stack on the bottom rail as it is raised.

It will also be appreciated that the upper component 45 of each slat is connected to the lower component 43 at the intermediate location 47 over a marginal area which encourages or biases, to some degree, the upper and lower components to be aligned and coplanar for some small distance beyond their interconnection. The more flexible the upper component the smaller the distance. The bias created at the intermediate location functions as a lever to bias the associated lower component upwardly but in the case of the illustrated embodiment of Figs. 1-4, the bias is not great enough to raise the lower edge of the lower component off the surface of the slat therebeneath with which it is slidingly engaged.

The uppermost slat in the illustrated embodiment is secured to the extruded element 44 by a flat bar 78 received on a ledge 80 within a groove 82 in the extruded element so that the uppermost slat is suspended from the extruded element with the remaining underlying interconnected slats in operative supported relationship.

A second embodiment of the covering in accordance with the present invention utilizes slats 63 as illustrated in Figs. 5-6C. It will there be seen that each slat is made of rigid or semi-rigid material and has a lower segment 64 that is arcuate in transverse cross-section, an upper segment 66 that is substantially flat or planar,

and a downturned tab 68 at the upper edge of the upper segment. The downturned tab is adapted to be secured with adhesive 69 or otherwise to an intermediate location 70 on the next adjacent upper slat as best illustrated in Fig. 5. As will be appreciated, the tab is secured to the next adjacent upper slat along an uppermost region of the lower arcuate segment 64 of the slat such that the upper segment 66 of each slat hangs substantially vertically when the fabric is extended similarly to the fabric illustrated in Figs. 1 and 2. While each slat could be formed, as by extrusion, such that the upper segment of each slat is perfectly flat or planar, in the disclosed embodiment, the slat is originally formed from a semi-rigid strip of material such as polyethylene, polyvinyl chloride, or the like, having preformed crease lines as best seen in Figs. 6B and 6C. Fig. 6C illustrates the upper segment of the slat before it has been straightened into the configuration shown in Fig. 6A and 6B and as will be appreciated, there are, for example, three creases 72 formed in the convex side of the slat along the upper segment 66 thereof and one crease 74 formed in the concave side adjacent to the top of the slat. The crease 74 in the concave side allows the tab 68 at the top of the slat to be easily defined by folding the uppermost edge of the slat material downwardly, and the three creases 72 in the convex side allow an opposite bend in the slat material, as best appreciated by reference to Fig. 6B, so as to form three small slightly arcuate sections 66a which in combination form the substantially planar upper segment of the slat. As will be appreciated in the illustrations, the slat size is exaggerated so the slightly curved nature of the three slat sections 66a appears pronounced even though in the actual product, the upper segment 66 of each slat appears substantially flat or planar.

By interconnecting or securing each slat 63 to the next adjacent upper slat as shown in Fig. 5, it will be appreciated a series of interconnected slats are formed with alternating slats being concave in opposite directions. In other words, the uppermost slat as seen in Fig. 5 is concave to the right while the next adjacent lower slat is concave to the left and the next adjacent slat is again concave to the right.

After the slats have been interconnected in this manner, they will have a relationship similar to that illustrated in Figs. 1-4 but due to the flexibility of the slats as created at least partially by the crease lines 72 and 74 which allow pivotal

movement particularly along the uppermost crease line 74 where the tab 68 is formed, the slats when fully extended have an appearance similar to that illustrated in Figs. 1 and 2. When partially retracted by raising the bottom rail 40 which is received in a pocket or crotch 76 defined between the lowermost two slats, the slats begin to expand away from each other so that alternate slats move in the same direction but opposite to that of an adjacent slat. The fully retracted position of the fabric would be similar to that illustrated in Fig. 4 where the slats are neatly stacked in a compact manner adjacent to a headrail such as the headrail 32 and behind a valence 34.

A third embodiment 84 of the present invention is illustrated in Figs. 7 and 8. In this embodiment, the headrail has not been illustrated but rather only the fabric 86 which comprises a support structure 88 and a plurality of interconnected slats 90.

With reference first to Fig. 7 and 7A, the support structure for this embodiment comprises a plurality of superimposed and interconnected closed cells 92 of hexagonal transverse cross-sectional configuration. The cells are made of a semi-rigid material such as resin reinforced fabric or the like, and can be formed in accordance with the teachings in U.S. Patent No. 6,572,725. Each cell includes a top wall 94 and a bottom wall 96 with the bottom wall of a cell being secured, as with adhesive or the like, to the top wall of the next adjacent lower cell. The cells further have side walls 98 having upper 98a and lower 98b segments with fold lines between the segments of each side wall so that the cells can be transversely compressed as shown in Figs. 7B-7E. When referencing the cells as closed, it is in reference to the transverse cross-sectional shape of the cell.

The slats 90, which are supported on the cellular support structure 88 are elongated rigid or semi-rigid slats of arcuate transverse cross-section having an upper margin 100 that is secured to the upper segment 98a of the front side wall 98 of an associated cell. The slat can be secured as with adhesive or any other suitable means such as ultrasonic welding or the like. In the disclosed embodiment, the slats are secured to every fourth cell so as to protrude forwardly from the cellular support structure but when the cellular support structure is fully extended as shown in Figs. 7 and 7A, the slats hang substantially vertically with the lower edge 102 of each slat slightly overlapping the upper margin 100 of the next adjacent lower slat as shown in

Fig. 7A so that the cellular support structure is not visible from the front of the fully extended fabric.

While the fabric could be moved from the fully extended position of Fig. 7A to the fully retracted position of Fig. 7D or 7E in any suitable manner, a lift system is shown in dashed lines in Figs. 7C and 7E which would encompass a plurality of vertically extending lift cords 104 supporting a bottom rail or ballast 106 which would be positioned beneath the lowermost cell in the support structure. By raising the lift cords and consequently the bottom rail, each cell is caused to collapse transversely as the fabric is moved from the fully extended position of Fig. 7A through a partially retracted position of Figs. 7B and 7C to the fully retracted position of Figs. 7D and 7E. As will be appreciated, in the fully extended position of Fig. 7 and 7A, the shade has the general appearance of a roman shade but when retracted as shown in Figs. 7D and 7E, the shade is very compactly stacked with the slats 90 protruding forwardly away from the support structure 88. It should be noted that the upper segment 98a of the cell, to which a slat is connected, serves as a lever in moving the connected vane substantially unitarily therewith. In other words, as a cell is compressed during retraction of the covering, the acute angle of the upper segment 98a relative to horizontal gets smaller thereby raising the slat toward a horizontal orientation.

A slightly different arrangement is illustrated in Figs. 8A and 8B with this arrangement having an identical support structure 88 to that of Figs. 7-7F, but the slats 108 are flat in transverse cross-section rather than arcuate. Such an arrangement provides a different aesthetic.

Figs. 9A-9D illustrate a fourth embodiment of the invention very similar to that of Fig. 7 wherein a support structure 88 in the form of a collapsible cellular material supports a plurality of rigid or semi-rigid slats 110 off the upper segment 98a of the side wall of every fourth cell on the front side of the support structure. The embodiment of Figs. 9A-9D, however, has an additional corresponding slat 112 on the rear side of the support structure with each rear slat being suspended from a corresponding top segment 98a of a side wall of a cell on the rear side of every fourth cell as shown in Fig. 9D. The slats suspended from the front and rear of the support structure 88 are identical and, as with the embodiment of Fig. 7, overlap the next

adjacent lower slat so that when the fabric is fully extended as shown in Figs. 9A and 9B, the cellular support structure is hidden from view. The structure is shown in a fully retracted position in Fig. 9C and a lift system 114 of the type previously described with the embodiment of Fig. 7 is shown in dashed lines. Again, the top segment 98a of each cell to which a slat is connected serves as a lever to raise the slat during retraction of the covering.

With reference to Figs. 10A-10D, a fifth embodiment of the invention is shown similar to the embodiment of Figs. 9A-9D with a support structure 88 in the form of collapsible interconnected hexagonal cells 92, but in this embodiment there are rigid or semi-rigid slats 99 secured to the top segment 98a of every third cell rather than every fourth cell and being disposed on the front and rear of the support structure, respectively.

With reference to Figs. 11A-11D, a variation 116 of the invention is shown similar to the embodiment of Fig. 7 with a support structure 88 in the form of collapsible interconnected hexagonal cells 92 but in this embodiment there are two sizes of rigid or semi-rigid slats 118 and 120 that are utilized to obtain a different aesthetic. The first slat 118 has an upper margin 122 secured to the top segment 98a of the front side wall of a cell with adhesive, ultrasonic bonding or the like and is arcuate in cross section as in the embodiment of Fig. 7 and overlaps three cells. The next adjacent lower slat 120, however, has a shallower depth than the first-described slat 118 but also has an upper margin 124 secured to the top segment of the side wall of an associated cell but this slat only overlaps two hexagonal cells rather than the three cells overlapped by the first or uppermost slat. Every other slat moving downwardly is of the same size with the fabric so formed creating a different aesthetic as viewed in the fully extended position of Figs. 11A and 11B and the partially retracted positions of Figs. 11C and 11D. As will be appreciated again, the top segment 98a serves as a lever in raising a connected slat during retraction of the covering.

A sixth embodiment of the present invention is shown in Figs. 12A and 12B wherein the support structure is a double row of interconnected hexagonal cellular structures with each row being identical to a hexagonal structure 88 described

previously but with each row being secured to the adjacent row along contiguous faces such as where an upper segment 98a of a cell engages a lower segment 98b of the next adjacent upper cell of the adjacent row. In this embodiment, the slats are similar to those illustrated in Figs. 11A-11D wherein alternating slats 101 overlap either two or three cells, respectively, with each slat being secured to the upper segment 98a of its associated slat so that the upper segment 98a can serve as a lever in moving the associated slat. The lower edges of each slat slightly overlap the upper edge of the next adjacent lower slat so that when in the fully extended position illustrated in Figs. 12A and 12B, a double row cellular structure is hidden from view from one side of the fabric.

A seventh embodiment of the present invention is illustrated in Figs. 13A and 13B, which is similar to that of the sixth embodiment except the support structure 88 is in the form of three rows of interconnected cellular structures with each row having superimposed interconnected cells of transverse hexagonal configuration and with each row interconnected with an adjacent row along the upper segments of the cells where they engage with the lower segment of the next adjacent upper cell of the adjacent row. Again the slats 101, as in the sixth embodiment, alternate in size with every other slat bridging two cells or three cells, respectively, and being connected along its upper edge to the upper segment 98a of an associated cell in a manner such that the upper segment 98a serves as a lever in moving an associated slat.

An eighth embodiment 256 of the present invention is illustrated in Figs. 14A-14D. In this embodiment, the support structure 258 is in the form of a pleated semi-rigid sheet of material which may be of the type found in pleated shades for window coverings. The support structure thereby defines forwardly downwardly sloped surfaces 260 as well as rearwardly downwardly sloped surfaces 262. The slats 264 for this embodiment of the invention comprise semi-rigid elongated strips of material of slightly arcuate transverse cross-section with each slat having an upper marginal zone 266 secured to a lower marginal zone 268 of a forwardly downwardly sloped surface 260 of the support structure. Fig. 14D shows the fabric 256 in a fully expanded position where the pleated support structure can be seen to extend almost vertically and with each slat overlapping the next adjacent lower slat and with the

slats themselves in combination defining a substantially planar wall parallel with the support structure while defining relatively thin cells 270 therebetween. Figs. 14A and 14B illustrate the fabric in a partially retracted condition with Fig. 14C showing the fabric in a fully retracted position with the slats forming substantially horizontal extensions away from the compressed support structure. It should be appreciated that the surfaces 260 to which a slat is connected serves as a lever in unitarily moving a slat therewith.

Figs. 15A-15D illustrate a variation 272 of the present invention that is very similar to that illustrated in Fig. 14A wherein the support structure 258 is again a pleated material of semi-rigid construction having horizontal fold lines to define forwardly downwardly 260 and rearwardly downwardly 262 sloped surfaces. There are a set of semi-rigid slats 264 of slightly arcuate transverse cross-section having marginal zones 266 along their upper edges secured to the forwardly downwardly sloping surfaces 260 and another set of identical slats 264 secured to the lower edge of the rearwardly downwardly sloping surfaces. The fabric is shown in a fully extended condition in Figs. 15A and 15D, and in a partially retracted condition in Figs. 15B and 15D. In this variation, the surfaces 260 and 262 serve as levers in moving associated slats in unison therewith.

A ninth embodiment of the invention is illustrated in Figs. 16A-16C and utilizes a sheet of flexible or semi-rigid material 304 as the support structure with the sheet of material being creased at 306 in opposite surfaces at vertically spaced locations so the sheet of material will easily fold at the crease line as shown best in Fig. 16B. The slats or vanes 308 are rigid or semi-rigid and are connected to opposite sides of the support sheet and are of arcuate transverse cross-section but have no tabs. Rather, the vanes are secured directly to the associated side of the support sheet 304 immediately above a crease 306. In this arrangement, when the fabric is fully extended, which might be assisted by a weighted bottom rail 310, the fabric has the appearance illustrated in Fig. 16A. The bottommost slat on the front face of the sheet of support material overlaps the bottom rail 310 for aesthetic purposes. As the weighted bottom rail is lifted, the bottom rail is drawn into a gap 312 between the lowermost slat on the front and rear face of the support sheet causing the slats to flare

outwardly in opposite directions and the support sheet to fold in an accordion-like manner as viewed in Fig. 16C in a partially retracted condition of the fabric. The sheet of material, along the surface where a slat is connected, serves as a lever in moving the slats during extension and retraction of the covering.

A tenth embodiment 372 of the present invention is shown in Figs. 17A-17C. In this embodiment of the invention, the support structure 88 is again formed from a plurality of interconnected semi-rigid cells 92 of hexagonal transverse cross-section which are transversely collapsible and wherein a plurality of rigid or semi-rigid slats 374 of arcuate transverse cross-section are secured to selected cells along one edge of the slat. The cells have top 376 and bottom 378 walls that are interconnected by side walls having upper 380 and lower 382 segments formed on opposite sides of creased fold lines 384. The slats 374 are secured to an upper segment 380 of one side wall along one edge so as to overlap an adjacent slat along the opposite edge when the fabric is extended as in Fig. 17A. The surfaces 380 to which a slat is connected serve as levers in moving the slats in unison therewith. This fabric arrangement can be seen to be identical to that illustrated in Fig. 7 except the fabric in Figs. 17A-17C is mounted horizontally and can be supported in a horizontal position within a framework 386 by horizontal support rods 388 extending through the cells 92 of the support structure. The fabric is shown in Fig. 17C in a fully expanded condition across the opening defined by the framework and as will be appreciated the slats extend in substantially parallel relationship with the cellular support structure. When the fabric material is retracted, as shown in Fig. 17B, the cells are transversely compressed and the slats hang downwardly therefrom in parallel relationship.

Figs. 18A-18D illustrate another arrangement 312 similar to that of Figs. 16A-16C except the support sheet 314 is preferably flexible and has not been horizontally creased at vertically spaced locations, but again the slats 308 which are rigid or semi-rigid and arcuate in cross-section are secured to the sheet at alternating locations on the front and rear of the sheet so the fabric resembles that of Fig. 16A except the support sheet passes through smooth curving lines rather than the folding lines established by the creases 306 of Fig. 16A. As in other embodiments, the sheet, at the locations where it is connected to a slat, serves as a lever in moving the slats during

extension and retraction of the covering. Fig. 18D shows the fabric of Fig. 18A in a partially retracted position with the slats flaring outwardly in opposite directions and the support sheet folded in a zigzag pattern above the bottom rail. Fig. 18C shows the fabric in a fully retracted position.

As will be appreciated from the above, the present invention encompasses a number of variations off the use of a flexible support structure with interconnected slats or vanes that are dependent in their movement upon leverage and the movement of the support structure to provide aesthetically pleasing and functional fabrics for coverings in architectural openings. It will be apparent to those skilled in the art that various combinations of the support structures, vanes or slats illustrated can be utilized within the spirit of the invention which have not been illustrated.

Although the present invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made by way of example, and changes in detail or structure may be made without departing from the spirit of the invention as defined in the appended claims.

WHAT IS CLAIMED IS:

1. A fabric for use in a covering for a building structure comprising in combination:

a flexible vertically extending support structure, and

a plurality of parallel elongated vanes supported at spaced locations along said support structure,

wherein movement of said vanes is substantially dependent on movement of said support structure.

2. The fabric of claim 1 wherein said vanes comprise semi-rigid slats secured to said support structure so as to form an acute angle with said support structure.

3. The fabric of claim 2 wherein said slats are flat.

4. The fabric of claim 2 wherein said flats are predominantly arcuate in transverse cross-section.

5. The fabric of claim 4 wherein said slats have a flap formed along one edge thereof and said slats are secured to said support structure along said flaps.

6. The fabric of claim 5 wherein said flap is reversibly bent relative to the remainder of the slat.

7. The fabric of claim 5 wherein said flap is bent to form an acute angle relative to the remainder of the slat.

8. The fabric of claim 2 wherein said slats are fully arcuate in transverse cross-section.

9. The fabric of claim 1 wherein said vanes include strips of flexible material.

10. The fabric of claim 9 wherein said vanes droop off said support structure.

11. The fabric of claim 2 or 9 wherein said support structure is a flexible sheet of material.

12. The fabric of claim 2 or 9 wherein said support structure is a pleated sheet of material.

13. The fabric of claim 2 or 9 wherein said support structure is a plurality of strands of flexible material.

14. The fabric of claim 2 or 9 wherein said support structure is a plurality of interconnected, transversely collapsible cells.

15. The fabric of claim 14 wherein said cells are hexagonal in transverse cross-section.

16. The fabric of claim 2 or 9 wherein said support structure is a plurality of parallel ribbons.

17. The fabric of claim 15 wherein each cell has front and rear side walls and each side wall has upper and lower segments and wherein said vanes are secured to said cells along at lease one of said upper segments.

18. The fabric of claim 17 wherein said vanes are secured to fewer than all of said cells.

19. The fabric of claim 14 wherein said vanes are connected to said support structure along locations where said cells are interconnected to each other.

20. The fabric of claim 1 wherein said vanes are interconnected with each other.

21. A fabric for use as a covering for a building structure comprising:

a plurality of interconnected slats forming a vertical panel, each slat having a top edge and an intermediate location and wherein the top edge of each slat is secured to the intermediate location of the next adjacent upper slat.

22. The fabric of claim 21 wherein at least a portion of said slats is made of a semi-rigid material.

23. The fabric of claim 22 wherein at least a portion of each slat is non-planar.

24. The fabric of claim 23 wherein said non-planar portion is arcuate.

25. The fabric of claim 24 wherein the arcuate portion of each adjacent slat in said fabric is convex in an opposite direction.

26. The fabric of claim 25 wherein a top of each arcuate portion coincides with said intermediate location.

27. The fabric of claim 26 wherein the portion of each slat above the intermediate location is substantially planar.

28. The fabric of claim 27 wherein the top edge of each slat has a reverse bend defining a flap for connection to the next adjacent upper slat.

29. The fabric of claim 21 further including a support structure in the form of at least one flexible element and a bottom rail secured to a lower end of said at least one flexible element such that vertical movement of said bottom rail will cause it to engage the lowermost interconnected slats in the fabric.

30. The fabric of claim 2 wherein said slats define in cross-section an upper and lower arcuate section and further include a fold line between said upper and lower arcuate sections.

31. The fabric of claim 30 wherein said support structure is a plurality of interconnected transversely collapsible cells.

32. The fabric of claim 31 wherein said slats have upper and lower edges and the upper edges of each slat are secured to a different cell.

33. The fabric of claim 9 wherein said support structure is a plurality of interconnected, transversely collapsible cells, and wherein said vanes are secured to said support structure adjacent to locations where said cells are interconnected.

34. The fabric of claim 14 wherein said cells are closed in transverse cross-section.

35. The fabric of claim 2 wherein said support structure is a pleated semi-rigid material defining forwardly/downwardly sloped segments and rearwardly/downwardly sloped segments, and wherein at least some of said slats are secured to said forwardly/downwardly sloped segments.

36. The fabric of claim 35 wherein some of said slats are secured to said rearwardly/downwardly sloped segments.

37. The fabric of claim 35 or 36 wherein said slats are arcuate in transverse cross-section.

38. The fabric of claim 5, 6 or 7 wherein said support structure is a flexible sheet of material.

39. The fabric of claim 38 wherein said slats are secured to a face of said sheet of material.

40. The fabric of claim 39 wherein said slats are secured to both faces of said sheet of material.

41. The fabric of claim 39 wherein said slats are arcuate in transverse cross-section.

42. The fabric of claim 4 wherein said slats have a concave side facing said support structure.

43. The fabric of claim 2 wherein said support structure is a plurality of interconnected, transversely collapsible cells and said slats are individually secured to individual cells.

44. The fabric of claim 43 wherein said fabric is vertically disposed.

45. The fabric of claim 43 wherein said fabric is horizontally disposed.

CELLULAR SHADE FOR COVERINGS FOR ARCHITECTURAL OPENINGS

ABSTRACT OF THE DISCLOSURE

A retractable cellular shade is illustrated in various embodiments to consist of a support structure that could assume numerous forms including cellular material, flexible sheets of material, tapes or ribbons, or flexible monofilaments or similar cords of natural or synthetic fibers with the support structure supporting a plurality of vanes or slats in various configurations and orientations. The movement of the vanes or slats is totally dependent upon movement of the support structure. The fabric so formed can be incorporated into a covering for architectural openings with the covering including a headrail with means for gathering the fabric material within the headrail.

Title: Retractable Shade for Coverings for
Architectural Openings
Inventors: Ralph G. Jelic et al.
Attorney Docket No. 33258/US

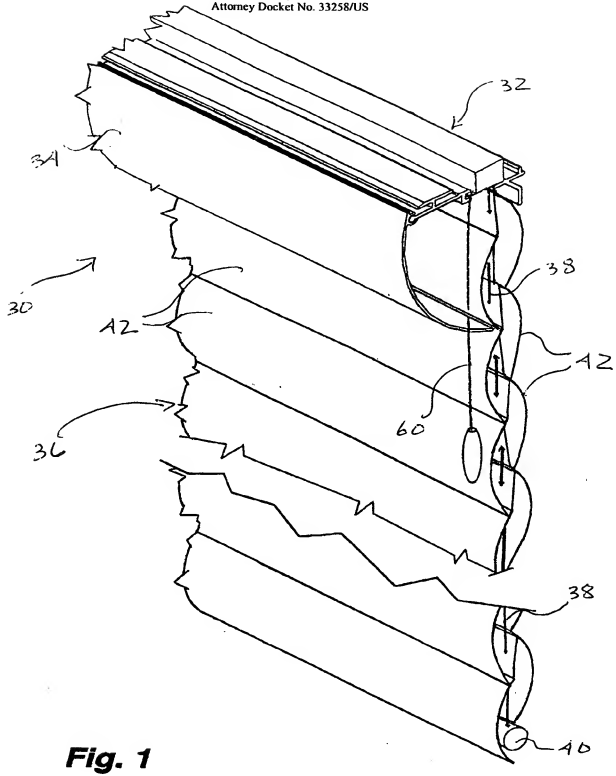


Fig. 1

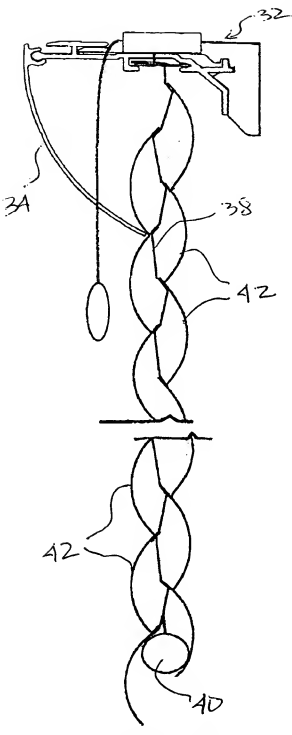


Fig. 2

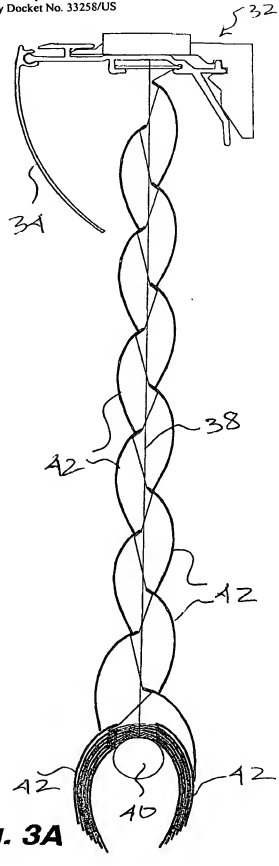


Fig. 3A

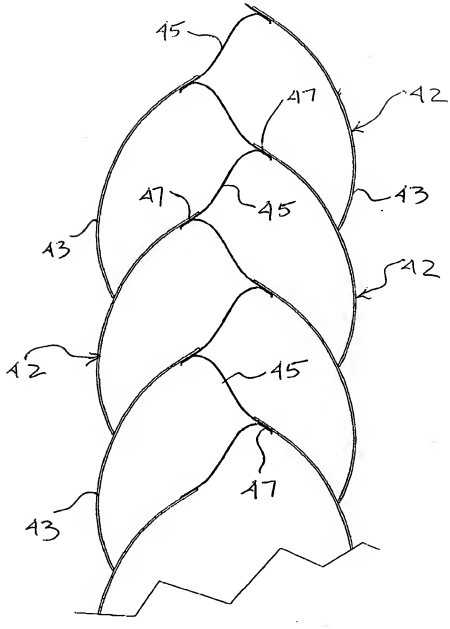


Fig. 3B

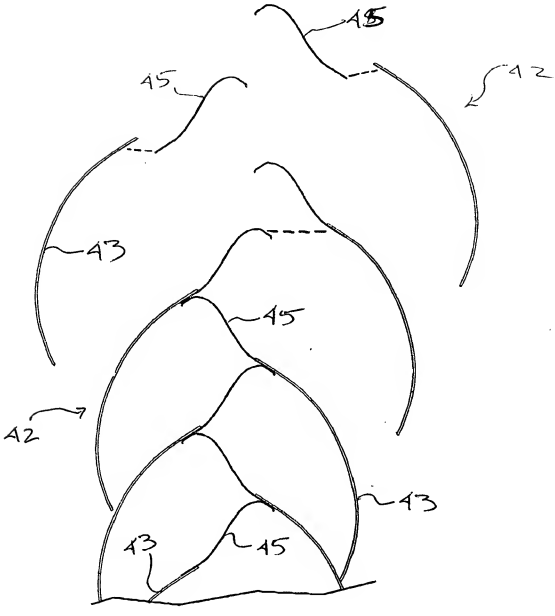


Fig. 3C

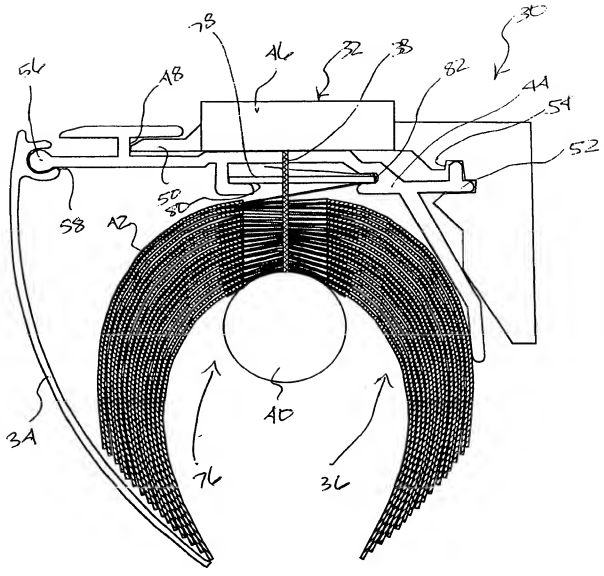


Fig. 4

Title: Retractable Shade for Coverings for Architectural Openings
Inventors: Ralph G. Jelic et al.
Attorney Docket No. 33258/US

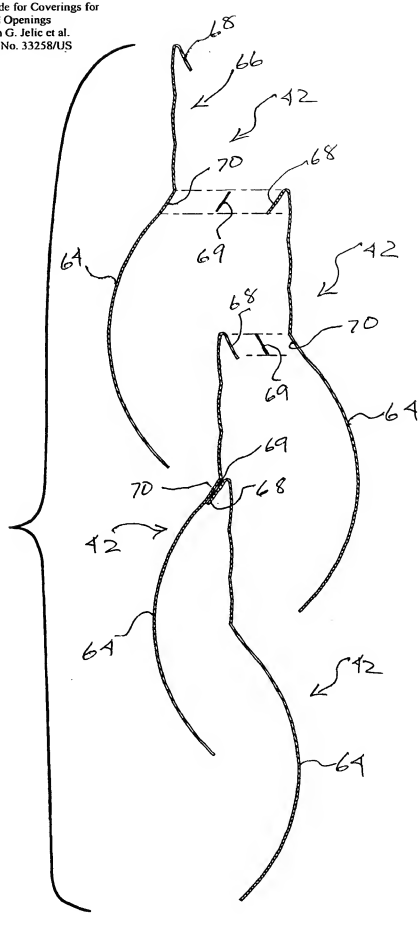


Fig. 5

Title: Retractable Shade for Coverings for Architectural Openings
Inventors: Ralph G. Jelic et al.
Attorney Docket No. 33258/US

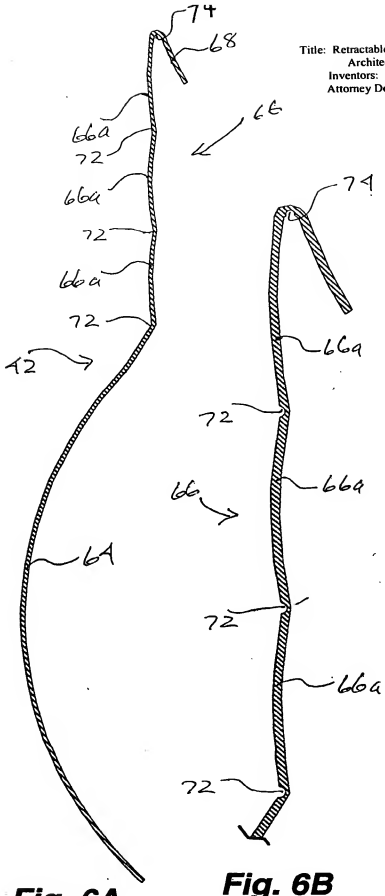


Fig. 6A

Fig. 6B

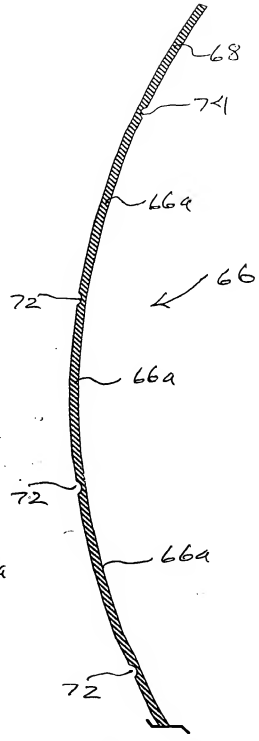


Fig. 6C

Title: Retractable Shade for Coverings for Architectural Openings
Inventors: Ralph G. Jelic et al.
Attorney Docket No. 33258/US

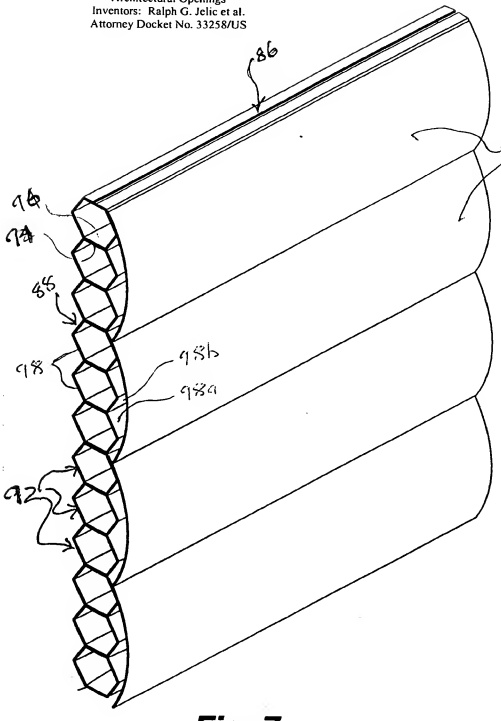


Fig. 7

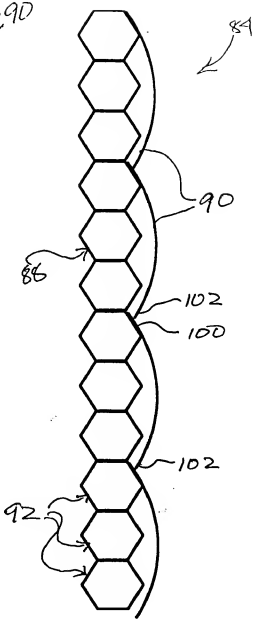


Fig. ~~8A~~ 7A

Title: Retractable Shade for Coverings for Architectural Openings
Inventors: Ralph G. Jelic et al.
Attorney Docket No. 33258/US

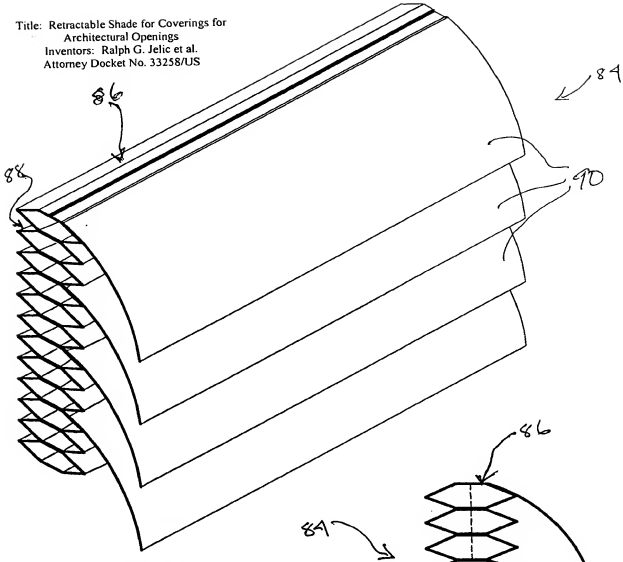


Fig. ~~8B~~ 7B

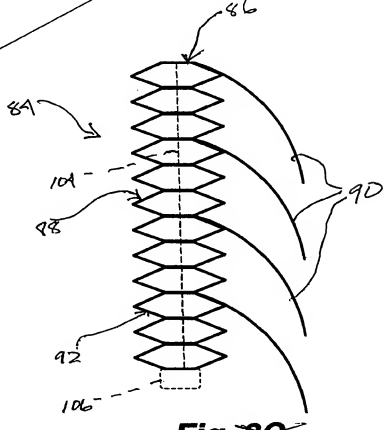


Fig. ~~8C~~ 7C

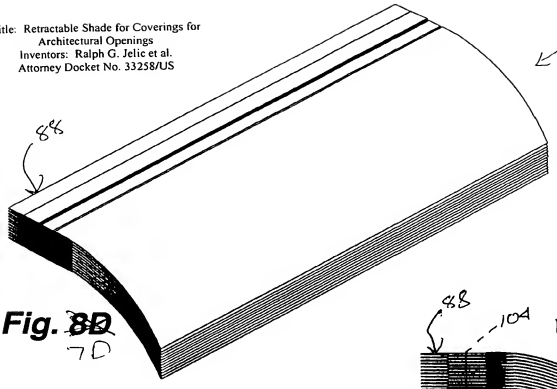


Fig. ~~8D~~
7D

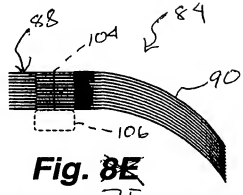


Fig. ~~8E~~
7E

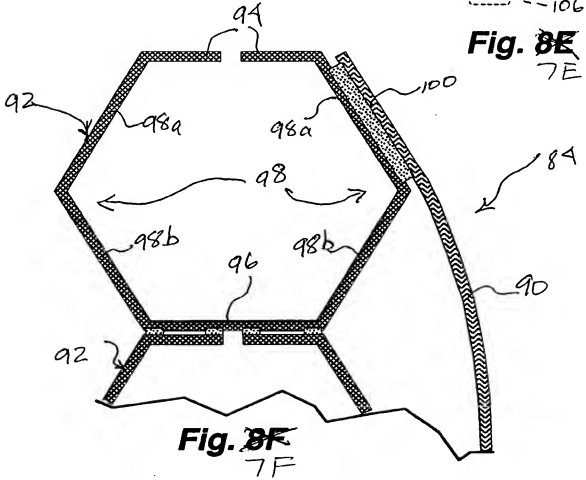


Fig. ~~8F~~
7F

Title: Retractable Shade for Coverings for Architectural Openings
Inventors: Ralph G. Jelic et al.
Attorney Docket No. 33258/US

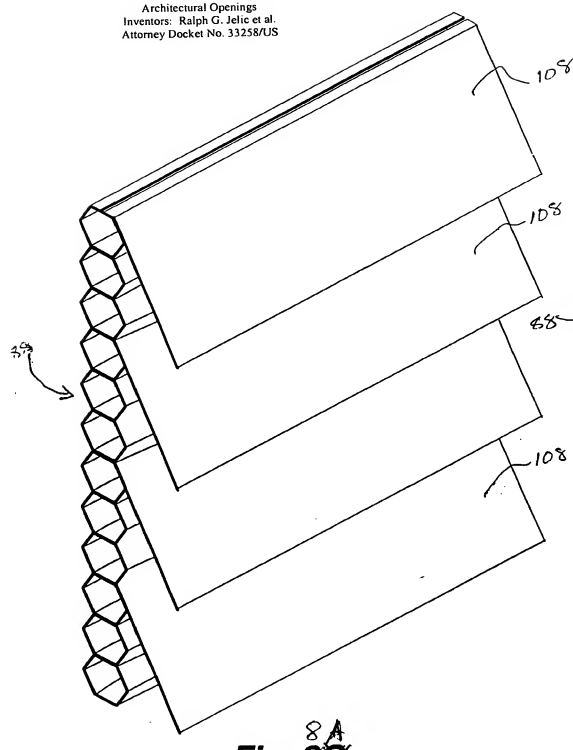


Fig. 8A

Fig. 8B

Title: Retractable Shade for Coverings for Architectural Openings
Inventors: Ralph G. Jelic et al.
Attorney Docket No. 33258/US

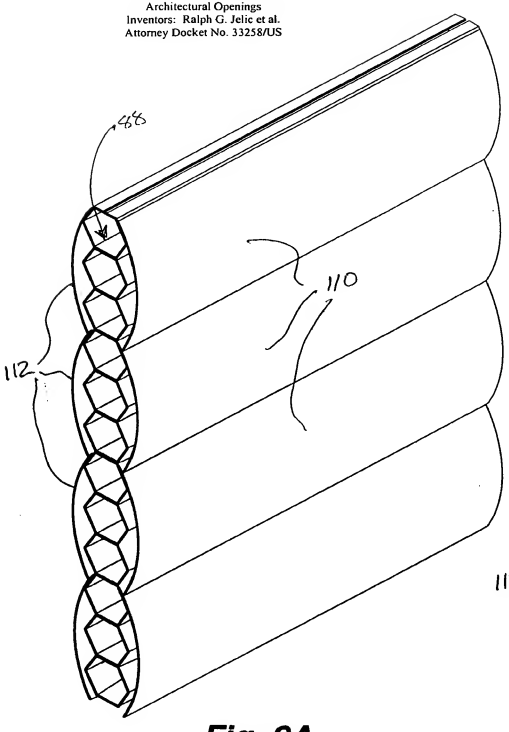


Fig. 9A

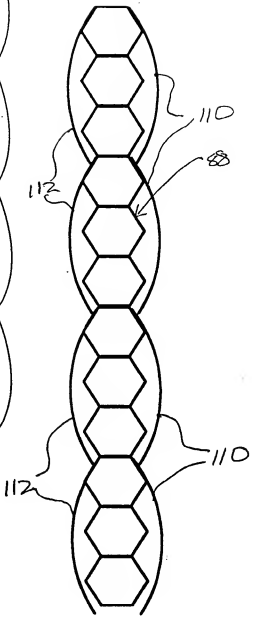


Fig. 9B

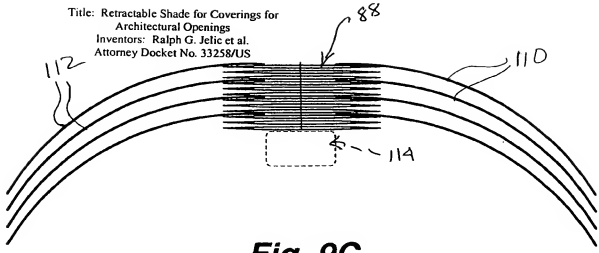


Fig. 9C

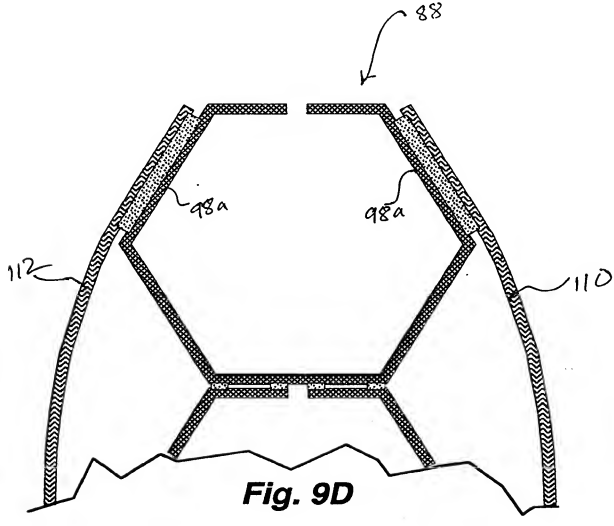


Fig. 9D

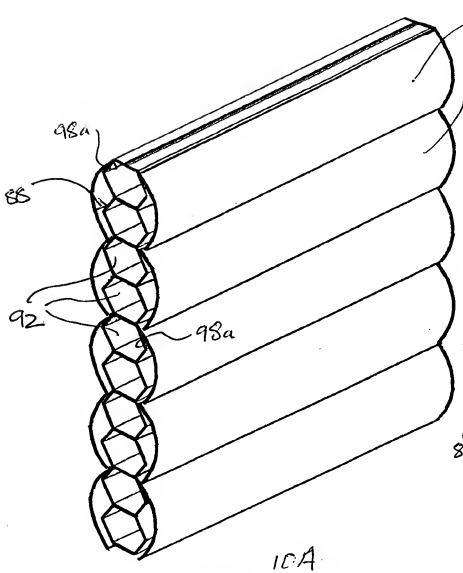


Fig. 9E 10A

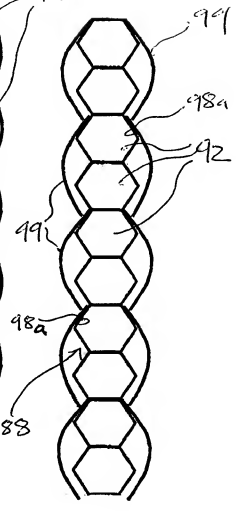


Fig. 9F 10B

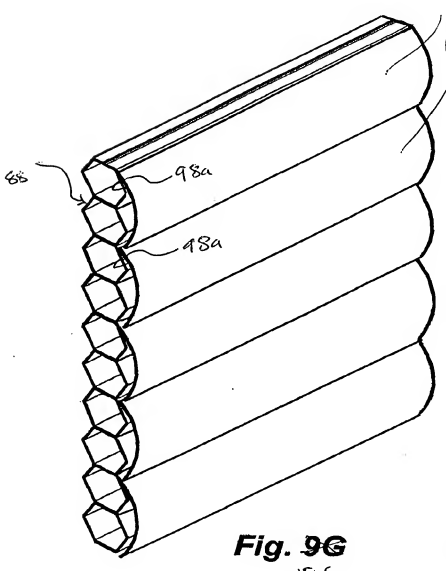


Fig. 9G

10C

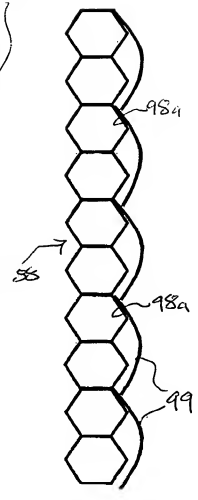
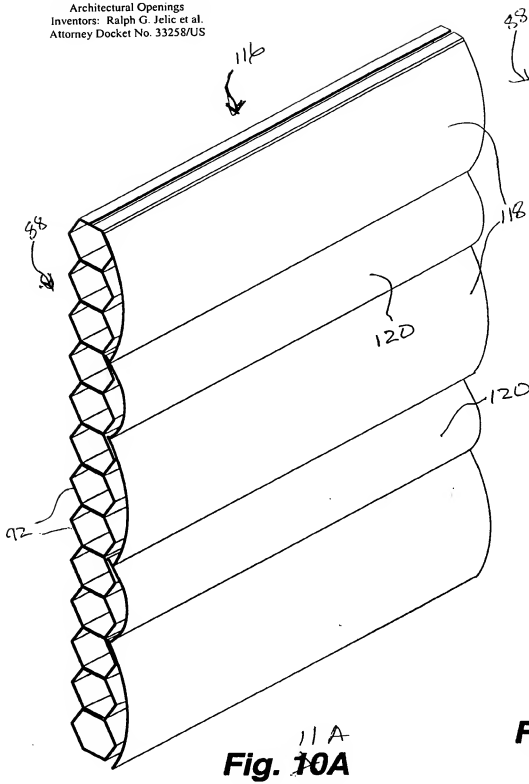


Fig. 9H

10D

Title: Retractable Shade for Coverings for Architectural Openings
Inventors: Ralph G. Jelic et al.
Attorney Docket No. 33258/US



11A

Fig. 10A

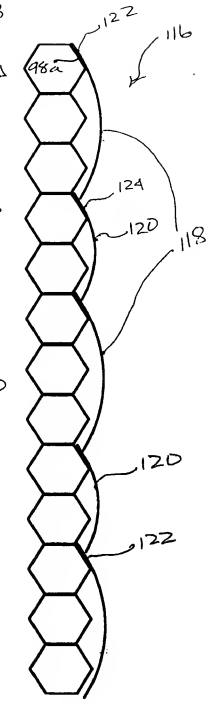
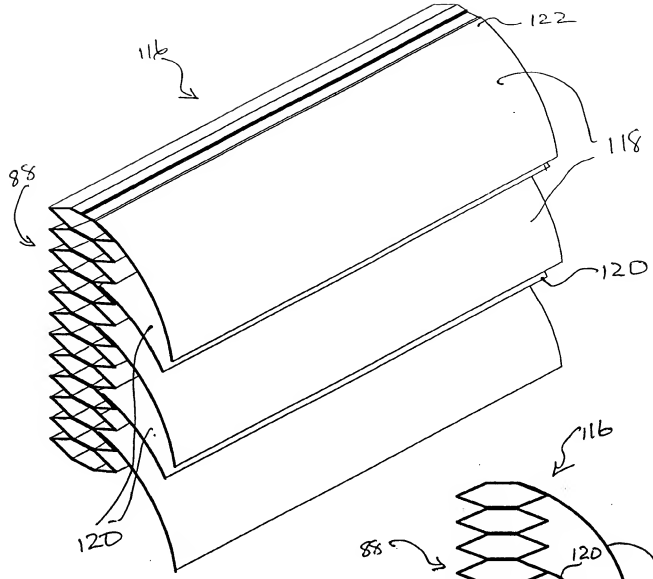


Fig. 10B

11B



11C

Fig. ~~10C~~

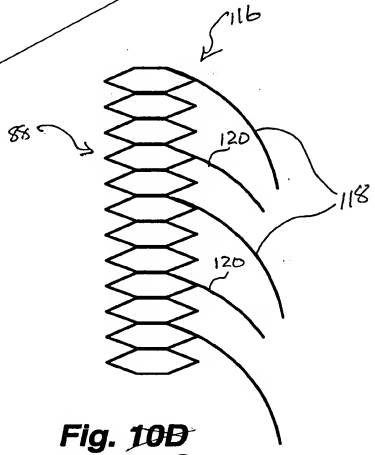


Fig. ~~10D~~

11D

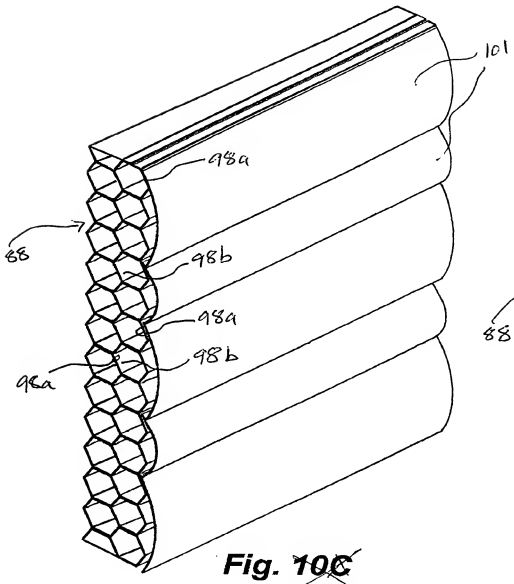


Fig. 10C

12A

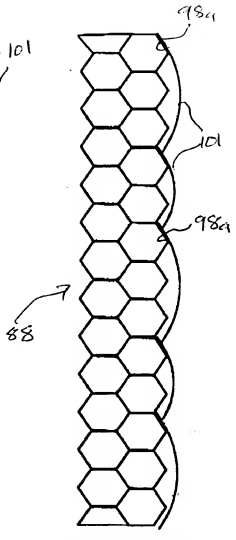


Fig. 10D

12B

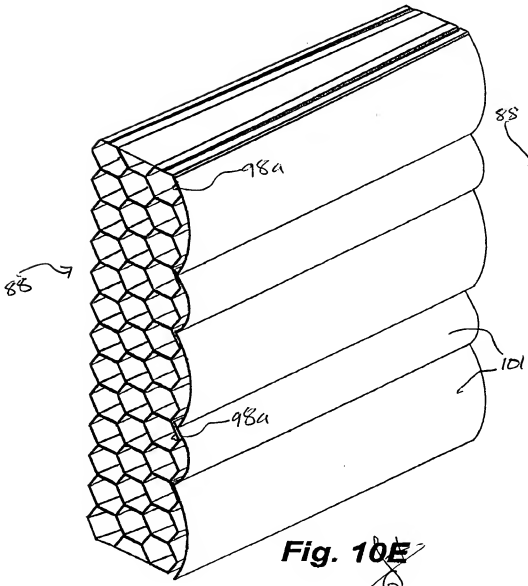


Fig. 10E

13A

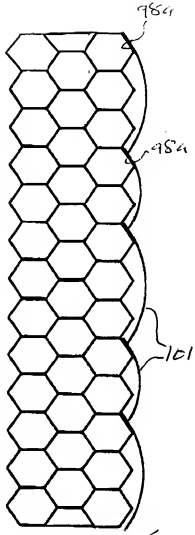


Fig. 10F

13B

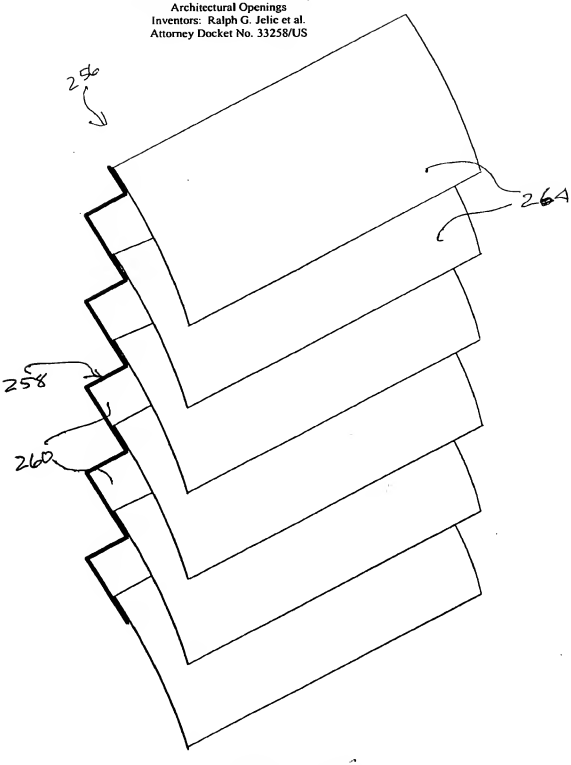


Fig. 14A

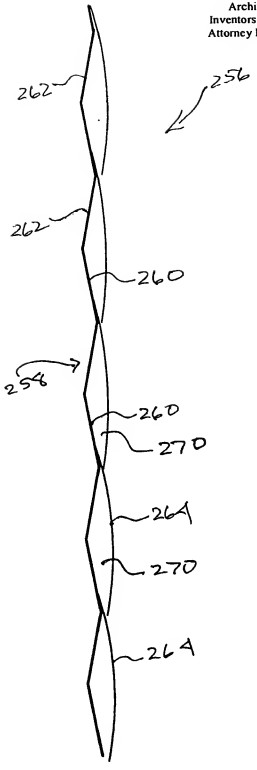


Fig. 14D

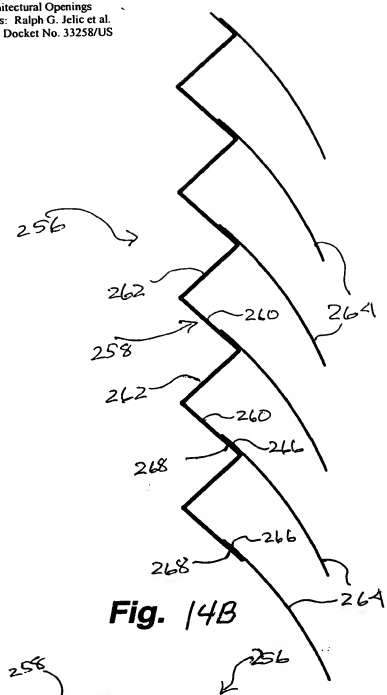


Fig. 14B

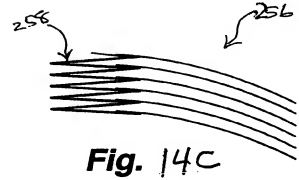


Fig. 14C

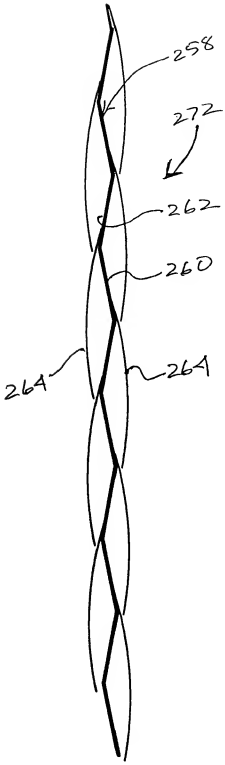


Fig. ~~15~~A
~~15~~A
15A

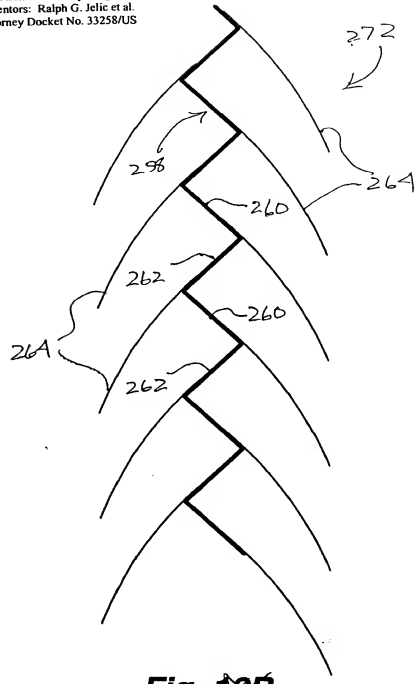


Fig. ~~15~~B
~~15~~B
15B

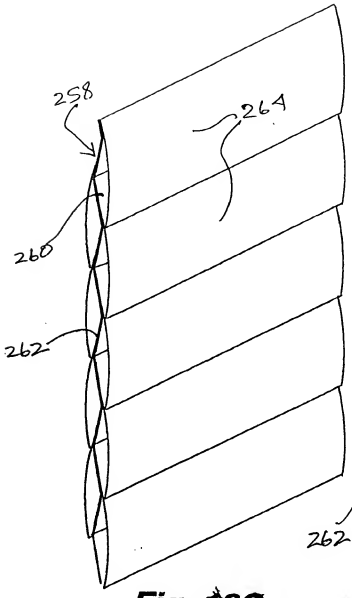


Fig. ~~19C~~ 15C

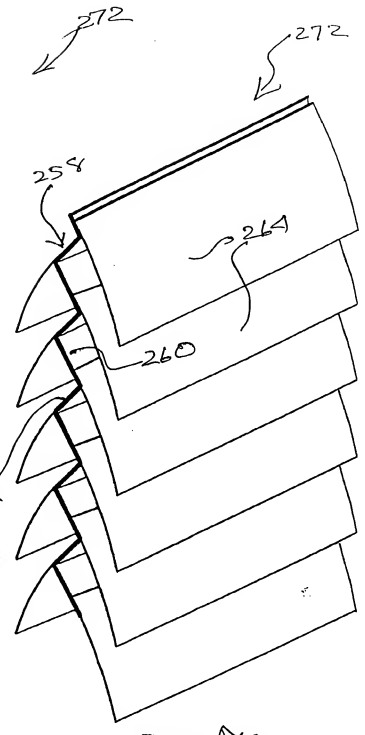


Fig. ~~19D~~ 15D

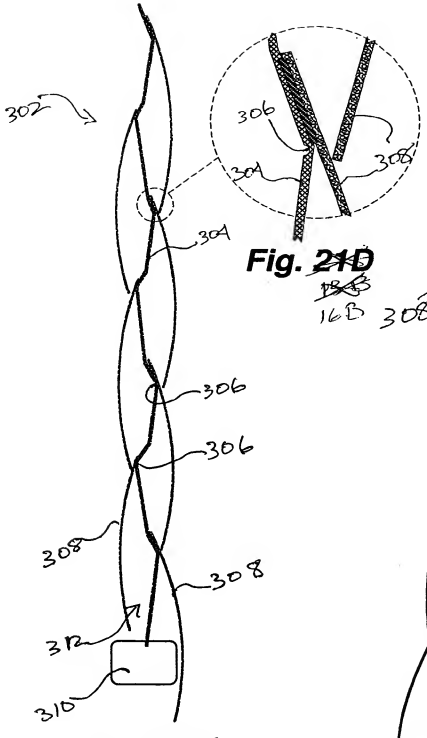


Fig. ~~21C~~
~~DSA~~
16A

Fig. ~~21D~~
~~DSB~~
16B

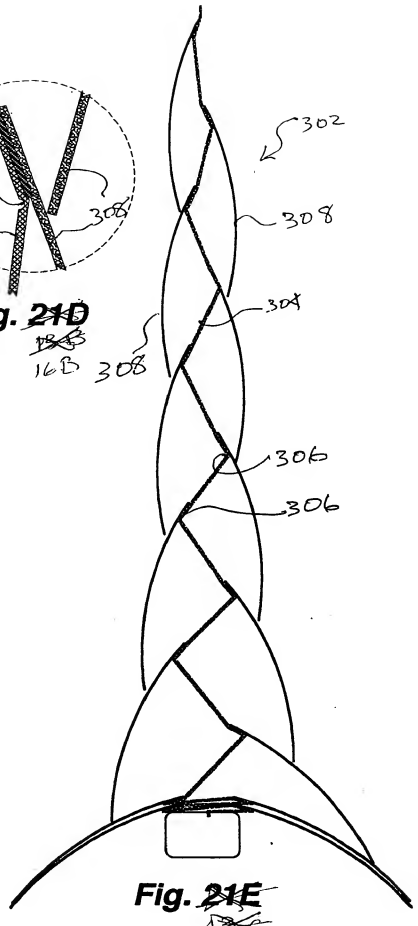


Fig. ~~21E~~
~~DSC~~
16C

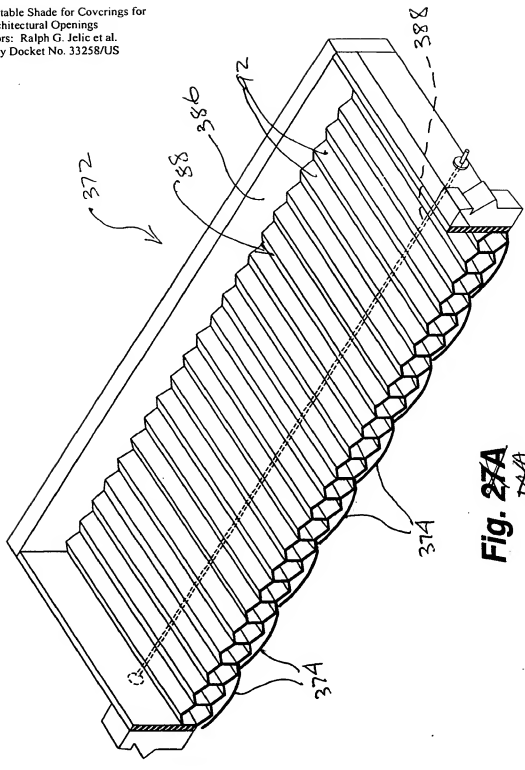


Fig. 27A

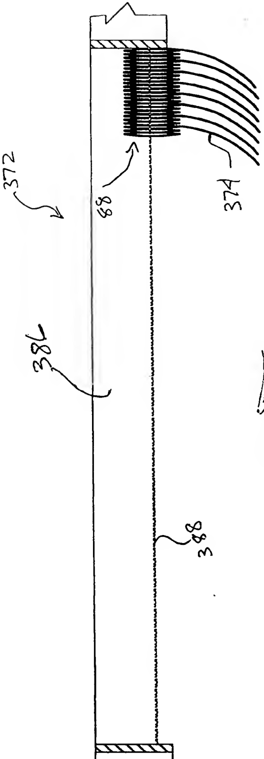


Fig. ~~27B~~ 17B

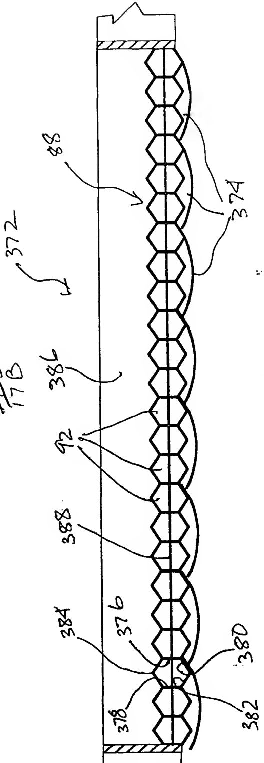


Fig. ~~27C~~ 17C

Title: Retractable Shade for Coverings for Architectural Openings
Inventors: Ralph G. Jelic et al.
Attorney Docket No. 33258/US

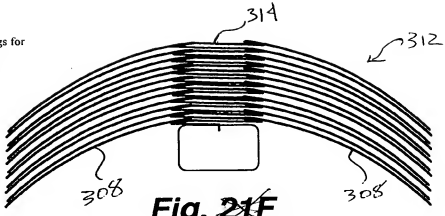


Fig. 21F

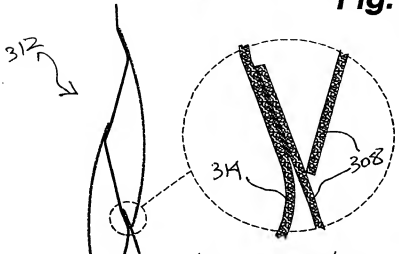


Fig. 21H

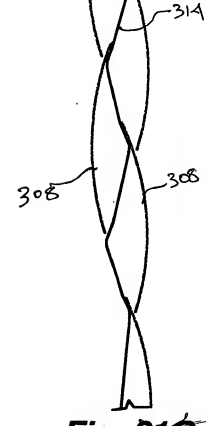


Fig. 21G

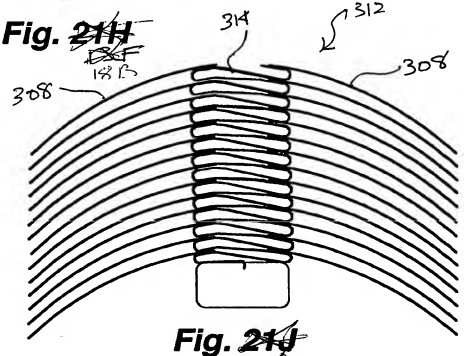


Fig. 21J